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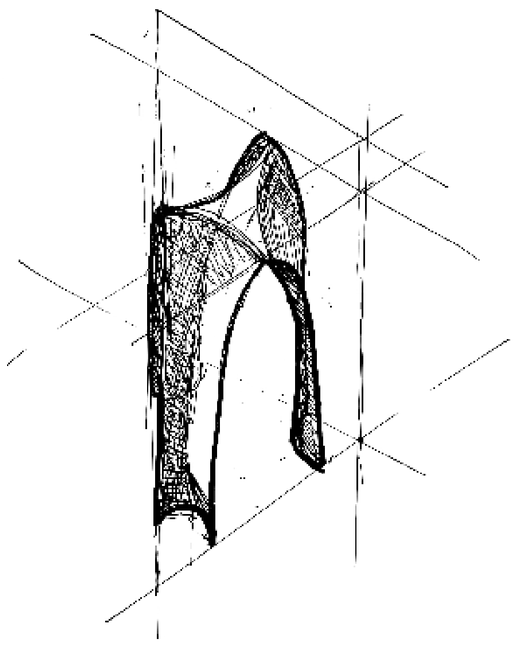

REPLACEMENT
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Concrete, a composite material made by bonding fillers like sand and gravel with a hydraulic binder, called Portland cement, is one of the most frequently used construction materials worldwide due to its abilitiy to be formed into almost any shape and high compressive strength. It's also cheap and easily available anywhere in the world. Because of these aspects, a massive industry has evolved around the material, projected to exceed 600 billion dollars in revenue by 2025. A global infrastructure has been implemented, with short transportation distances, also because the material is curing very fast and needs to be produced near the constructon site. While this material has a lot of positive aspects and revolutionized the world we're living in today, it also has a huge impact on the global CO2 emissions. It is estimated to produce about 8% of the global greenhouse gas emissions and is liable for about 2.8 billion tons of carbon dioxide per year. These numbers mostly occur because of the huge amount of energy needed in the production of Portland cement. In this process, clinker, consisting largery of limestone ($CaCO_3$), is first produced by burning it at about 1450°C. After that, it is mixed with calcium sulfate and grinded to achieve the final product.
In the end, the decarbonation of limestone, the fuel combustion of the kiln as well as the elctrical power generation and the transportation are producing CO_2 emission at all stages of the process. Because of these big environmental impacts, other alternatives have been gaining more popularity in the recent years.
In this project, Magnesiumoxychloride cement (MOC) is analyzed and applied into a small scale structural system, in this case a chair, demonstrating the possible potential as a more sustainable alternative to Portland cement.

Magnesiumoxychloride cement (MOC), also known as „Sorel cement", was first produced in 1867 by its inventor Stanislas Sorel. The non-hydraulic binder consists of the dissolution of Magnesiumoxide (MgO) in an aqueous solution of Magnesiumchloride ($MgCl_2$), forming an homogenous gel-like cement. It is able to bind all kinds of fillers, from granite to sawdust, resulting in good compressive and tensile strengths. Especially in the 20th century, MOC cement mixed with sawdust called „wood stone" was often used as flooring because of its marble like appearance.
MgO is usually obtained either by the calcination of mined magnesite ($MgCO_3$), called dry route, or by the wet route, in which MgO is extracted from magnesium rich solutions by the precipitation of $Mg(OH)_2$. Typical are solution mining brines, but the precipitation can also happen with seawater. Since the wet route happens to be complex and needs a lot of energy, MgO is mostly obtained by the dry route. MgO is also considered to be carbon neutral or even carbon negative because of its ability to carbonate with atmospheric carbon dioxide.

Caustic calcined Magnesiumoxide (CCM)
burnt at 800°C suits best for MOC usage because of its high reactivity.

Magnesiumchloride flakes ($MgCl_2$)
are dissolved in water before mixing with CCM to create MOC.

Sawdust (filler)
is a wasteproduct of the timber industry.